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November 14, 2014

Mr. John Mannix
Assistant Superintendent for Operations
Monroe School District
Monroe Public Schools Administration Building
200 E. Fremont
Monroe, WA 98272

Subject: **Preliminary Indoor Air Quality Assessment Report**
Sky Valley Education Center – East Pod
EHSI Project 10693-01

Dear John:

At your request, EHS-International, Inc. (EHSI), an environmental health and safety consulting firm, conducted a preliminary indoor air quality assessment in the East Pod of the Sky Valley Education Center located at 351 Short Columbia St., Monroe, Washington. The results and conclusions are included in the attached report.

EHSI is pleased to provide our professional industrial hygiene services. If you have any questions concerning this report or if EHSI can provide further services to you, please call me at (425) 455-2959.

Sincerely,

EHS-International, Inc.

Clinton Holzhauer, LEED AP, CMC
Manager, Indoor Air Quality Services

Sky Valley Education Center
Preliminary Indoor Air Quality Assessment
East Pod

Exterior entrances to Classrooms 10 and 11
Sky Valley Education Center
351 Short Columbia St., Monroe, WA

Prepared for:

Mr. John Mannix
Assistant Superintendent for Operations
Monroe School District
Monroe Public Schools Administration Building
200 E. Fremont
Monroe, WA 98272

November 14, 2014
EHSI Project 10693-01

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EHS-International, Inc.

PRELIMINARY INDOOR AIR QUALITY ASSESSMENT
SKY VALLEY EDUCATION CENTER – EAST POD
MONROE, WASHINGTON

EXECUTIVE SUMMARY

On November 6th, 2014, EHS-International, Inc. (EHSI), an environmental health and safety consulting firm, conducted a preliminary indoor air quality (IAQ) assessment in the East Pod of the Sky Valley Education Center (Sky Valley) located at 351 Short Columbia Street, Monroe, Washington. The assessment was conducted due to concerns expressed by several teachers regarding the air quality in the East Pod.

The results from this indoor air quality assessment indicate that there is not a mold problem in the classrooms assessed. Laboratory analysis of air samples collected in classrooms indicated that they had airborne fungal particulate concentrations that were less than or similar to outdoor concentrations on the day of testing. Although there is not a mold problem in the subject classrooms, older carpet near exterior doors has been repeatedly wetted and dried over many years and may support some (a few square inches of) microbial growth when allowed to remain wet for several days.

EHSI believes the reported symptoms which include headaches, sinus issues and sneezing are more likely related to under-ventilation of the spaces as indicated by indoor carbon dioxide concentrations that exceed 1,000 parts per million (ppm) during classroom sessions. The build-up of carbon dioxide indicates that other gases and particulates associated with people and their activities also likely build-up when the classrooms are in session which can lead to the reported symptoms and concerns.

EHSI recommends increasing the amount of ventilation provided to classrooms by adjusting intake vent dampers and fan speeds, and/or utilizing the existing but not operational exhaust-only mechanical system in the East Pod. In addition, EHSI recommends that carpet directly inside exterior doors be removed and replaced by non-porous flooring such as tile or vinyl.

This report provides information derived from a walk-through assessment of East Pod and its vicinity, a visual assessment of heating, ventilating and air conditioning (HVAC) components, measurements of IAQ parameters, measurement of the moisture content of building materials and the collection and analysis of air samples for fungal and non-fungal particulates.

BACKGROUND

Prior to the assessment EHSI was provided with information from recent activities intended to evaluate the air quality within the East Pod of Sky Valley. The provided information included:

- Monroe Public Schools *Indoor Air Quality Report Forms* from three (3) teachers assigned to the East Pod Classrooms 9, 10 and 11. The forms provide information regarding the perceived problems and symptoms as well as any activities that may have taken place to address the concerns. Reported symptoms included acute headaches, sinus issues, burning eyes, "pressure" in the head, sneezing and neck pain.

- An *Indoor Air Quality Data Sheet* completed by Mr. Ralph Yingling, Monroe Public Schools Director of Facilities and Operations, on or around October 20, 2014. Information regarding temperature, relative humidity, indoor carbon dioxide concentrations, moisture meter measurements and air flow measurements in East Pod Classroom 11. The data indicates that temperature and relative humidity were in acceptable ranges, the moisture of the carpet was around 15% on a wood equivalent scale and carbon dioxide concentrations were elevated with several measurements of approximately 1,700 ppm.

- An *Indoor Air Quality Review and Conclusion* form was provided by Mr. Yingling discussing the results obtained on the *Indoor Air Quality Data Sheet* dated October 20, 2014, and subsequent actions. Based on the elevated carbon dioxide concentration the unit ventilator fan in Classroom 11 was set on the high setting to introduce more outdoor air into the classroom. The form recommended utilizing the exhaust-only mechanical system currently present but not operating in the East Pod if IAQ concerns persist. Finally, the sheet suggests that the carpet's moisture content could be reduced by additional air flow, as may be provided by using the "high" setting on the unit ventilator.

- A six (6) page laboratory analytical report from *Immunolytics*, a microbiology lab located in Albuquerque, New Mexico and dated October 28th, 2014. The *Immunolytics* report indicates that a settling plate collected in a "Classroom" and received by the laboratory for analysis had twelve (12) total colonies and a table in the report suggests that results with "9 or greater total mold colonies per area (Classroom)" "is hazardous [and] illness [is] likely in individuals who are susceptible." The report indicates that one or more colonies of *Candida*, *Cladosporium*, *Epicoccum sp.*, *Geotrichium*, *Microsporum* and *Penicillium* were present on the setting plate received by the laboratory.

SITE DESCRIPTION

The Sky Valley Education Center is a facility used by Monroe Public Schools for home schooling students and other alternative forms of education. The East Pod is one of three "pods" located around a central library area in a one-story building that is part of the Sky Valley Education Center. The subject building was likely built in the 1960's and portions have been renovated and/or revised several times. The East Pod has five (5) classrooms radiating from a central common area (see Floor Plan in Appendix A). The building is slab on grade, exterior walls are brick and the ceilings are wood. Interior walls include gypsum wallboard and wood-product paneling. Windows along the exterior wall are single pane glass in aluminum frames. Single pane windows in wood frames are present on the walls separating individual classrooms from the East Pod central common area (Photo 1).

Each classroom has a teacher's desk, some storage space and desks and chairs for students. Since each classroom is used for different fields of study the contents in each classroom differ. At the time of the assessment Classroom 9 was being used as a science classroom (Photo 2), Classroom 10 was being used as a computer lab (Photo 3) and Classroom 11 was being used as a language classroom.

Each classroom has a unit ventilator, located along an exterior wall (Photo 4), which conditions air and provides outdoor ventilation air. The unit ventilators were manufactured by American Air Filter (AAF)/McQuay, Inc., a division of Daikin, and were reported to be approximately five years old at the time of the assessment. The unit ventilators have only a few fan speeds which must be set while the unit ventilator front panels are removed. Filters, with a MERV value of 8 or less, are located within the unit ventilators and reportedly changed out quarterly (Photo 5). Air intakes for the unit ventilators are located near ground level on exterior walls (Photo 6). Several of the unit ventilators observed had dampers on the exterior air inlet and were protected against skate board damage by additional caging around the grilles (Photo 7). The dampers for Classrooms 9 and 10 appeared to be more than 50% closed. The exterior air inlet for the unit ventilator in Classroom 11 did not appear to have dampers. The outdoor air inlets for the three classrooms of interest were on the side of the building opposite the school's parking lot.

It was reported that in addition to the unit ventilators the East Pod has a dedicated exhaust system with most components located above the ceiling in the central common area and exhaust ducts on upper walls in each classroom. It was reported that the exhaust system was installed at approximately the same time as the unit ventilators but that it had not been used in several years because it created drafts and cold zones in the adjacent library area.

The carpet in each of the classrooms assessed was reportedly approximately twenty-five (25) years old. The carpet, applied with mastic directly to the concrete floor slab showed wear and age in areas, especially by exterior doors. It was reported that the carpet is cleaned annually and that recent cleanings have been conducted with only a steam (water) extraction followed by opening exterior doors to provide enhanced drying.

APPROACH

The preliminary IAQ assessment included: a walk-through assessment of the facility and its vicinity to note potential pollutant sources and building design; a visual assessment of accessible HVAC components; measurement of IAQ parameters including temperature, relative humidity, carbon monoxide, carbon dioxide and airborne particulates in selected areas; measurement of the moisture content of building materials in areas suspected of being impacted by moisture; and collection of air samples for the laboratory determination of airborne fungal and non-fungal particulates.

IAQ Parameters

A TSI Q-Trak Plus Model 8554 IAQ Meter was used to measure the IAQ parameters of temperature, relative humidity, carbon dioxide and carbon monoxide as spot checks in selected areas. Some measurements and observations were collected when the classrooms were not in session while others were collected immediately before or after a classroom session. The Q-Trak was also used to data-log measurements in several classrooms during session (Appendix D).

Typically, temperatures in the range of 68 to 74° Fahrenheit (°F) are considered comfortable and relative humidity is recommended to be less than 60%. Relative humidity greater than 60% may create environments conducive to mold growth.

While the current version of the American Society of Heating, Refrigeration and Air Conditioning (ASHRAE) Standard 62.1-2013, *Ventilation for Acceptable Air Quality*, does not provide a recommended upper limit for carbon dioxide concentrations, past versions of the standard recommended that carbon dioxide concentrations be maintained below the outdoor air carbon dioxide concentration plus 700 ppm. EHSI is aware that some facilities try to maintain indoor carbon dioxide concentrations below 1,000 ppm. Carbon dioxide concentrations provide an indication of ventilation within a space.

Carbon monoxide is a colorless and odorless gas that can cause illness and/or death at elevated concentrations. The US Environmental Protection Agency (EPA) National Ambient Air Quality Standards (NAAQS) have set eight-hour and one-hour average limits for carbon monoxide of 9 and 35 ppm, respectively.

Air Flow Rate

The volume of air provided to classrooms from unit ventilators was determined by measuring the air speed at the supply vent of the unit ventilator using the vane anemometer on a Kestral Model 3500 Pocket Weather Meter. Four (4) air speed measurements were collected from each of three vents. The average air speed, measured in feet per minute, was multiplied by the area of the vents (in square feet) to provide a measure of the amount of air provided to the space, as cubic feet per minute (CFM).

Airborne Particulates greater than 0.3µm

A GT-521S MetOne Laser Particle Counter was used to determine the concentration of airborne particulates greater than 0.3 micrometers (µm) in diameter as spot checks in selected areas. The particle counter can report the quantity of the airborne particulates but cannot provide any information regarding the composition of the particulates. The particulates in the range of 0.3 µm and above were measured because these are the particulates sizes most likely to enter deep into the lungs during respiration.

Airborne Particulates – Laboratory Analysis

Samples for the laboratory determination of fungal and non-fungal airborne particulates were collected from the two indoor locations, Classrooms 9 and 11. A third sample, to be used as a comparator when evaluating the analytical results, was collected of outdoor air approximately six feet from the exterior door to Classroom 11. The air samples were collected using Zefon Air-O-Cell™ air sampling cassettes. Samples were collected by passing 150 liters of air through each cassette during a ten-minute period. Indoor sampling was considered "semi-aggressive" as carpet in several areas of the classroom was pulled back and visually assessed during air sample collection. It was raining lightly during collection of the outdoor comparator sample.

Airborne particulate samples were submitted to Lab/Cor, Inc. (Lab/Cor) of Seattle, Washington, under "chain-of-custody" control. Lab/Cor is staffed by microbiologists and participates in the American Industrial Hygiene Association's Environmental Microbiology Proficiency Testing (AIHA EMPAT #101858). Optical microscopy was used to observed characteristic morphologies at a magnification of approximately 600x. Results are reported as total particulates per cubic meter of air (pts/m^3). Laboratory analytical results are presented in Appendix B.

Moisture Content of Materials

A Tramex Moisture Encounter Plus moisture meter was used to determine the moisture content of building materials at the time of the assessment. The moisture meter has several scales which gives it the ability to measure the moisture content of several building material types including: wood/timber, drywall/roofing, and plaster/brick. The moisture meter does not have a setting for carpets so the meter was set to the wood/timber scale and the results for the moisture content of carpets are reported as "wood scale equivalent" (WSE) and should be evaluated relative to other carpet moisture measurements. Carpet with a WSE reading of 15% may have a different moisture content than wood with a WSE reading of 15%.

The assessment was conducted on Thursday, November 6th, 2014, by Mr. Clinton Holzhauer, EHSI Manager of Indoor Air Quality Services and a Certified Microbial Consultant (CMC).

WALK-THROUGH ASSESSMENT

The following information, pertinent to IAQ, was derived from observations and information collected during a walk-through assessment of the East Pod.

Classroom 9

Classroom 9 appeared to be used as a science classroom and had contents including magnets, building blocks and toys, a collection of sand and silt in jars and a fish tank that was empty except for several sealed bottles of fluids and several other, non-liquid, non-odoriferous items. Classroom 9 also had several computer stations and a spray bottle of Expo white board cleaner.

Classroom 10

Classroom 10 appeared to be used largely for computers with approximately half the available seats providing access to computers.

Classroom 11

On the day of the assessment Classroom 11 was being used as a language classroom. The contents of Classroom 11 included white board markers (~ 6), four sealed cans of latex paint in a cabinet, a spray bottle of "neutral cleaner" reportedly intended for stripping wax from hard flooring, and a new spray bottle of a bleach-based cleaner.

The carpet by the exterior door was being held in place by duct tape (Photos 8 and 9). The carpet mastic was well-cured with most on the concrete slab and some on the carpet backing (Photo 10). The carpet by the exterior door, approximately 1 x 4-feet in area, has a small area of discoloration with a "crusty" texture (several square inches) on the lower side (Photo 11) where it was closest to the exterior door. No suspect visible mold growth was associated with this area of discoloration but microbial growth may be present if/when this area of the carpet remains wet for a period of time.

A Bionaire space heater was observed in the classroom.

East Pod Central Common Area

The East Pod central common area was an active space with more than twelve (12) students at all times during the assessment. The central common area has no specific HVAC equipment except the exhaust-only equipment located above the ceiling and reportedly not used for at least several years.

MEASUREMENT & ANALYTICAL RESULTS

IAQ Parameters – Spot Checks

Table 1 below provides a synopsis of the measurement results for the IAQ Parameters of temperature, relative humidity, carbon monoxide and carbon dioxide as well as airborne particulates greater than 0.3 µm in diameter.

Table 1
Sky Valley Education Center - East Pod
IAQ Parameters
November 6, 2014

Location	Time	Temp (°F)	RH (%)	CO_2 (ppm)	CO (ppm)	Pts >0.3µm (pts/ft^3)
Rm 11	9:30	70.9	60.3	641	0.5	377,880
Rm 11 at SA	9:32	81.9	52.0	592	0.1	283,260
Rm 11	9:50	70.5	53.0	557	0	292,720
Rm 11 at SA	9:51	67.6	59.6	533	0.4	296,270
Rm 10	10:05	70.0	69.6	994	0	359,170
Rm 10 at SA	10:06	68.2	71.3	869	0.2	347,620
Central Pod	10:11	70.7	71.4	1184	14.8	365,040
Central Pod	10:11	71.1	70.1	1157	3.8	---
Central Pod	10:12	71.8	69.6	1212	2.0	---
Central Pod	10:13	72.3	67.7	1250	1.5	---
Library	10:14	72.7	64.2	1161	0.4	348,090
Central Pod	10:16	72.7	62.1	1169	0.7	359,650
Rm 9	10:27	70.0	58.4	752	0.4	259,160
Rm 9	10:50	69.8	59.0	812	0.3	---
Rm 11	10:50 – 11:50	Data-logging during Classroom session; ~ 15 – 20 students (see Appendix D)				
Rm 9	12:01 - 13:22	Data-logging during Classroom session; ~ 20 students (see Appendix D)				
Central Pod	13:25	72.9	59.1	1091	0.2	235,590
Library	13:28	73.2	57.9	1035	0.1	214,870
Rm 10	13:38	68.9	63.8	747	0	215,940
Rm 11	13:48	72.6	59.2	1141	1.0	182,090
Rm 11 SA	13:50	68.7	66.8	945	9.1	152,150
Rm 11 SA	13:51	69.3	69.0	1015	0.2	---
Outdoor Air	13:34	61.3	70.3	402	0.6	231,340

ppm = parts per million; µm =micrometer; > = greater than; pts/ft^3 = particulates per cubic foot of air;
SA = Supply Air Vent at Unit Ventilator; --- = Not Measured; highlighted entries indicate supply air from ventilators.

IAQ Parameters – Data-Logging

Information regarding the results of data-logging IAQ parameters in Classroom 9 and 11 are presented in Appendix D and discussed below.

Classroom 11

Data-logging conducted in Classroom 11 while approximately twenty (20) students were in session indicates that the carbon dioxide concentration increased from approximately 700 ppm to a high of 855 ppm before it fell gradually to approximately 750 ppm. The average carbon dioxide concentration during the classroom session was 782 ppm.

The carbon monoxide concentration was always less than 1 ppm.

The temperature rose from a before session temperature of approximately 69.5° F to a high of 71.6° F shortly after the class session began. The temperature then decreased to approximately 70° F and stayed there for the remainder of the class session. The average temperature during the class session was 70.3° F.

The relative humidity in the classroom started slightly above 59% and decreased throughout the class session to a relative humidity of approximately 55%. The average relative humidity during the class session was 56.5%.

Classroom 9

Data-logging in Classroom 9 commenced prior to the start of a class session. The average carbon dioxide concentration during the data-logging period was less than the average during the class session.

Data-logging conducted in Classroom 9, while approximately twenty (20) students were in session, indicates that the carbon dioxide concentration increased from approximately 700 ppm to a high of 1,180 ppm before it fell gradually to approximately 800 ppm. The average carbon dioxide concentration during the data-logging period was 901 ppm.

The carbon monoxide concentration was always less than 1 ppm.

The temperature rose from a before session temperature of approximately 70.0° F to a high of 72.3° F shortly after the class session began. The temperature then decreased to approximately 70° F and stayed there for the remainder of the class session. The average temperature during the data-logging period was 70.8° F.

The relative humidity in the classroom started below 56% and increased to 58.8% shortly after the class session began. The average relative humidity during the data-logging period was 57.1%.

Air Flow Rates and Volume of Supply Air Provided

The amount of air supplied by the unit ventilators in Classrooms 9, 10 and 11 are presented in Table 2. The unit ventilator in Classroom 11 was set on "high" while the other unit ventilators in the other two classrooms were set below "high". The percentage of outdoor air in the supply air was not measured.

Table 2
Volume of Supply Air Provided by Unit Ventilator
Sky Valley Education Center
November 6, 2014
Reported as Cubic Feet per Minute (CFM)

Classroom	CFM of Supply Air
Classroom 9	553
Classroom 10	892
Classroom 11	1,050

Airborne Particulates - Laboratory

The fungal and non-fungal airborne particulates identified by the laboratory in the samples collected indoors were compared with the fungal and non-fungal particulates identified in the outdoor air comparator sample. A discussion of the sampling method used to obtain these results and those provided by *Immunolytics* will be presented in the DISCUSSION OF RESULTS portion of this report.

Airborne Fungal and Non-Fungal Particulates

The laboratory identified eight (8) mold types in Classroom 11, six (6) mold types in Classroom 9 and nine (9) mold types in outdoor air. All the mold types identified in Classroom 9 were also identified, in higher concentrations in the outdoor air comparator sample, except *Ganoderma* which had a slightly higher concentration in the indoor sample. One of the mold types identified in Classroom 11 was not also identified in the outdoor air comparator sample (*Pithomyces*) and the remainder of the mold types identified in Classroom 11 were identified at similar or higher concentrations in the outdoor air comparator sample. Analytical results in which indoor air fungal concentrations are less than or similar to outdoor air fungal concentrations indicate a "normal" indoor fungal environment and do not indicate an indoor mold problem.

Table 3 presents a synopsis of the laboratory analytical results for airborne fungal particulates. The laboratory results are presented in Appendix B.

Table 3
Airborne Fungal Particulates
Sky Valley Education Center – East Pod
November 6th, 2014
Results Presented as Fungal Particulates per Cubic Meter of Air (pts/m³)

Mold Type	Classroom 11	Classroom 9	Outdoor Air
Ascospore	100	300	867
Aspergillus/Penicillium-like	667	200	2,100
Basidiospores	800	1,400	6,600
Cladosporium	233	133	700
Epicoccum	---	---	67
Ganoderma	100	167	100
Hyphal Fragments	33	200	100
Myxo./Periconia/Smuts	33	---	67
Pithomyces	100	---	---
Rust Spore	---	---	67
Total	**2,066**	**2,400**	**10,668**

--- = Not Identified

Table 4 presents a synopsis of the laboratory results for airborne non-fungal particulates. The laboratory results are presented in Appendix B.

Table 4
Airborne Non-Fungal Particulates
Sky Valley Education Center – East Pod
November 6th, 2014
Results Presented as Particulates per Cubic Meter of Air (pts/m³)

Particulate Type	Classroom 11	Classroom 9	Outdoor Air
Algae	100	33	133
Amorphous Particulates	41,800	33,567	967
Cotton Fibers	700	1,000	33
Crystalline Particulates	58,300	22,567	1,733
Dander	5,367	12,400	300
Insect Parts	33	---	---
Manufactured Fibers	33	67	---
Paint Spheres/Chips	1,567	2,267	---
Soot	1,667	1,400	33
Starch	200	67	---
Total	**109,767**	**73,368**	**3,199**

--- = Not Identified

Moisture Content of Materials

The moisture content of gypsum wallboard (GWB) and brick walls were all less than 10% when measured using the appropriate scales. In all areas measured both the concrete slab and the carpet had moisture measurements of less than 5% on the "Plaster/Brick" scale.

In order to understand the distribution of moisture in carpet the wood/timber scale was used and all results should be considered relative.

Table 5
Relative Moisture Content of Carpet
Sky Valley Education Center – East Pod
November 6th, 2014
Results Reported as Wood Scale Equivalent (%)

Location	By Exterior Door	Center of Classroom
Classroom 9	15 - 21	15
Classroom 10	17 – 30	17
Classroom 11	15 – 18	15
Central East Pod	---	14

The highest reading (30%) was obtained immediately inside the exterior door in Classroom 10. The higher readings in Classroom 9 were also from carpet in close proximity to the exterior door.

DISCUSSION OF RESULTS

Carbon Dioxide and Ventilation

Based on the results provided in the *Indoor Air Quality Data Sheet* and the *Indoor Air Quality Review and Conclusion* form, as well as the measurements collected during this IAQ assessment EHSI believes that ventilation is the largest factor in the current IAQ concerns. Carbon dioxide concentrations, measured as spot checks and data-logged on the day of the assessment, indicate that providing additional outdoor air ventilation to the classrooms of concern would likely reduce the IAQ complaints.

The results indicate that the amount of ventilation being provided to Classroom 11 was increased recently by increasing the fan speed on the unit ventilator. However, the amount of ventilation provided to Classrooms 9 and 10 was less than that provided to Classroom 11. Carbon dioxide concentrations exceeded 1,000 ppm at times in Classrooms 9 and 10 on the day of the assessment.

Elevated carbon dioxide concentrations are often associated with symptoms including headaches and reports of "stuffiness". More importantly, carbon dioxide is considered a surrogate for other airborne contaminants. Carbon dioxide concentrations are an easily measured air quality parameter and elevated carbon dioxide indicates that ventilation may be less than desirable. When ventilation is less than desirable airborne contaminants may build up in a space. Many other airborne contaminants are less easy to measure than carbon dioxide so carbon dioxide is used as a surrogate.

Mold Analytical Results – Settling Plates versus Spore Trap Sampling

The results from air sampling for fungal particulates indicate that the results from indoor samples collected on the day of the assessment are less than or similar to the results from the outdoor comparator sample. There were a couple of mold types in the indoor samples that were not also in the outdoor sample but they were in low concentrations and are not considered significant.

EHSI understands that the analytical results provided by *Immunolytics* can be interpreted as cause for concern. However, EHSI has reviewed similar data in the past and considers the collection techniques to be inadequate and the reporting format to be misleading. A discussion of the *Immunolytics* results is provided below.

The sample collected and submitted to *Immunolytics* is considered a settling plate sample. Settling plates were commonly used when microbiologists were first developing the methods and techniques necessary to accumulate a body of knowledge. However, settling plates are currently not often used for a number of reasons. The settling plates can only be useful for viable mold spores, those that can grow and thrive on specific growth media (agar). The sampling method employed by EHSI analyzes total fungal spores, both viable and non-viable. This is important because even non-viable spores can be detrimental to an individual's health. Settling plates do not collect or report non-viable types of fungi.

Another reason settling plates are not typically used is that they provide no indication of the volume of air necessary to create the results. Typically the settling plate instructs the sampler to remove the cover from the petrie dish and set it out on a horizontal surface for 1 to 10 minutes. This does not allow for an understanding of how many fungal spores are in the air at the time of sampling.

When sampling for viable microorganisms different agars are often used depending on the type(s) of organisms to be analyzed. Not all organisms can grow and thrive on all agars. For instance, *Stachybotrys sp.* mold (not identified in this assessment) is a mold of interest but it only grows on specific agars. In the case of *Immunolytics* a Sabouraud Dextrose agar was used. There can also be an uncertainty regarding the sterility of the collection media (agar) used.

A further difference between the *Immunolytics* results and those provided by EHSI is that EHSI used a laboratory accredited for microbial analysis by the American Industrial Hygiene Association and that participates in periodic proficiency testing in which they analyze known standards as unknowns and have the potential to lose their accreditation if they are unable to meet certain performance standards. *Immunolytics*

may have the ability to correctly do the analysis but without maintaining ongoing certification for this type of testing it is difficult to assess the consistency or correctness of the laboratory.

As the *Immunolytics* report indicates "[m]old is found in all environments and is a vital part of our ecosystem". EHSI considers the report's table indicating that "9 or greater total mold colonies per area (Classroom)" to be "hazardous [with] illness likely in individuals who are susceptible" to be unfounded and misleading at best. There are currently no regulations for appropriate concentrations of airborne fungal particulates and any guidelines developed are generally applicable only in some circumstances.

Finally, mold growth requires moisture. Chronic or continuous moist conditions are required for growth for some types of mold. Currently the EPA and other groups do not encourage air sampling as part of a mold assessment because the conditions necessary for mold growth can often be determined during a walk-through assessment and the use of moisture meters. The collection of air samples for mold analysis is recommended when: affected individuals may be immune-compromised and the type of mold present is important, legal proceedings may take place, or hidden growth is suspected. Laboratory analytical results alone cannot fully assess an area contaminated with mold. In this case, EHSI collected samples to verify/refute the findings of *Immunolytics* and to determine whether any non-fungal particulates may be present that could explain the reported concerns.

Airborne Non-Fungal Particulate Results

Although the Laser Particle Counter and the analytical laboratory both provide a quantification of airborne particulates in a space they do so in different ways so that it is not possible to directly compare the results. While the Laser Particle Counter counts all particulates greater than 0.3 µm in diameter the microscopist at the laboratory is only able to quantify particulates that are visually distinct using microscopic techniques. In most cases particulates that are less than 1 µm in diameter are indistinguishable to the microscopist.

While some types of particulates are small, such as soot, other types of particulates start large and break down or disintegrate into smaller pieces over time. Fragments of particulates are more difficult to identify than whole particulates. Many smaller airborne particulates are likely fragments of what were once larger pieces. In quiescent environments many airborne particulates eventually settle unto surfaces. Settled particulates are frequently re-aerosolized (re-suspended in air) due to wind or other physical activities.

Measurements taken with the Laser Particle Counter indicate that indoor concentrations of airborne particulates ranged from 182,000 to 377,000 pts/ft^3 while the outdoor concentration at the time of the assessment was 231,000 pts/ft^3. Based on a database from Healthy Buildings, Inc., an in-house data-base, these concentrations are average or slightly below the average for airborne particulates in an indoor location. Indoor spaces with more than 800,000 pts/ft^3 are more likely to have IAQ concerns expressed related to airborne particulates.

Laboratory results indicate that the total non-fungal airborne particulates differed more than the Laser Particle Counter results in the spaces tested. Classroom 11 had 109,767 pts/m^3 and Classroom 9 had 73,368 pts/m^3 while outside air had only 3,199 pts/m^3. These results indicate that the concentration of airborne non-fungal particulates, especially larger particulates, is greater in Classroom 11 than in Classroom 9. As is typical, the concentrations of amorphous particulates (very ground up fragments), dander (human skin cells) and crystalline particulates (very tiny rocks and rock dust) were the most plentiful type of particulates in the indoor environment. It is typical for indoor non-fungal particulate concentrations to be greater than the concentration in outdoor air because the source of many of the particulates is indoors. Particulates that are most likely from indoor sources include: cotton fibers, dander, manufactured fibers, paint spheres and chips, and starch.

Carpet

The carpet in the subject areas was old. Carpet directly adjacent to the exterior door thresholds has greater discoloration and shows evidence of having been wetted in the past. The evidence includes discoloration, a small area with "crusty" texture and loss of adhesion to the concrete slab. Despite past repeated wettings there does not appear to be associated mold growth.

It is well-known that entrance thresholds become wetted by people entering the building from outside or from water passing beneath the door threshold. In this case it doesn't appear likely that water passed below the doorway so the most likely reason the carpets become wet at the thresholds is because wet shoes tracked in moisture from outdoors.

Carbon Monoxide

While measuring IAQ parameters as spot checks in the East Pod several measurements indicated carbon monoxide concentrations above 9 ppm. Elevated carbon monoxide measurements were collected in the central common area at 10:11 and from Classroom 9 unit ventilator supply air at 13:50. Repeat measurements were collected in both locations to verify the initial readings. In both cases the carbon monoxide concentrations greatly decreased less than a minute after the initial high readings.

CONCLUSION

The preliminary IAQ assessment conducted by EHSI on November 6th, 2014, indicates that there is no mold contamination in the East Pod classrooms of interest. Regardless of the results from the settling plate both the walk-through assessment with a moisture meter and the results from testing for airborne mold indicated that fungal concentrations in the areas tested were typical of other indoor environments not impacted by mold contamination.

EHSI did find that the amount of air provided to Classrooms 9 and 10 was less than that provided to Classroom 11 and carbon dioxide concentrations above 1,000 ppm were measured in Classrooms 9 and 10.

Provided information indicates that carbon dioxide concentrations in Classroom 11 also exceeded 1,000 ppm at times prior to the unit ventilator fan speed increase at the end of October. EHSI believes it is the lack of adequate ventilation that has caused IAQ concerns to be raised by some teachers.

Unexpected elevated carbon monoxide concentrations were measured twice during the assessment in the East Pod. In both cases the elevated readings quickly decreased suggesting that the carbon monoxide was from a transient rather than a fixed source. The source of the carbon monoxide is unknown. The East Pod does not have natural gas or propane service and the classrooms of interest are on the opposite side of the building from the parking area.

RECOMMENDATIONS

The following recommendations are likely to have a positive impact on the IAQ within The East Pod of the Sky Valley Education Center.

- Increase the amount of air provided to Classroom 9 and 10. This can be accomplished by turning up the unit ventilator fan speed. It may be necessary to further open the dampers for the unit ventilators in Classrooms 9 and 10 in order for more outdoor air flow to enter the building. If carbon dioxide measurements indicate that the concentration during class sessions is 1,000 ppm or above in any of the classrooms then it may be necessary to use the existing exhaust-only system to enhance airflow in the Pod. The amount of air provided by the unit ventilator in Classroom 11 was recently increased so that carbon dioxide concentrations measured during a Classroom session on the day of the assessment remained below 1,000 ppm.

  Note: The noise level generated by unit ventilators with fans set to "high" may be considered unacceptable by some, especially in a quiet teaching environment. Lower fan settings produce less noise but supplemental ventilation would likely be required in order to provide enough outdoor air to maintain carbon dioxide levels less than 1,000 ppm.

- The carpets in close proximity to the exterior doors (approximately 2 x 3-feet) should be removed and replaced with a non-porous surface that will not be impacted by repeated wetting and drying. The use of a mat atop the carpet would protect the carpet but if used the mats should be regularly cleaned and turned so that all sides of the mat, as well as the carpet beneath, have an opportunity to dry.

- Consider installing a carbon monoxide sensor in the central common area of the East Pod to continuously monitor for carbon monoxide.

LIMITATIONS AND STANDARD OF CARE

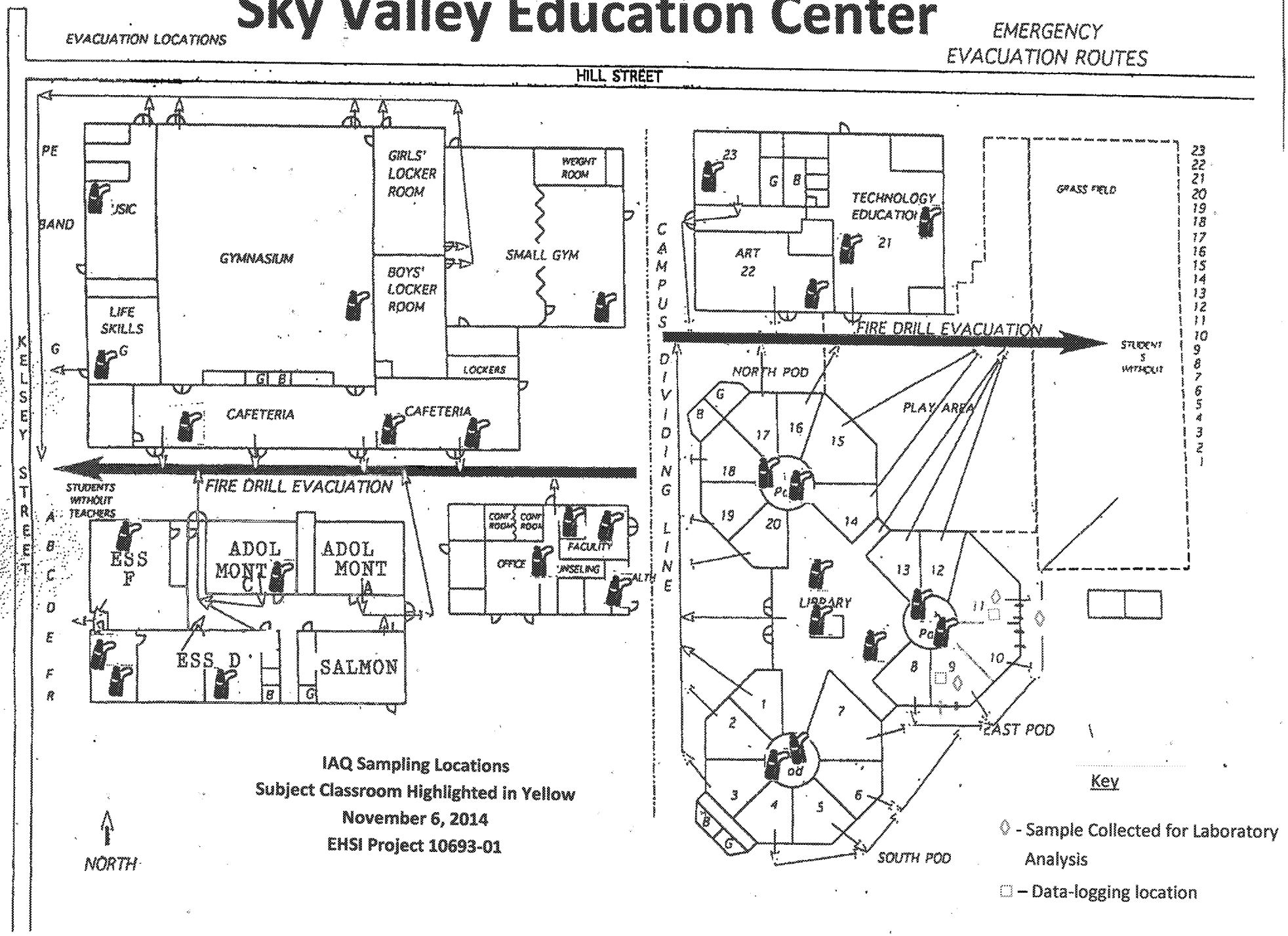
This preliminary indoor air quality assessment was conducted by EHSI in accordance with the Scope of Work defined by EHSI Proposal 14-232, and authorized by Monroe School District #103 Purchase Order 1851400081, dated November 5, 2014.

During the assessment it was noted that the date/time of the Q-Trak had not been updated to account for the recent switch to Pacific Standard Time. The date/time was changed partway through the day and the data-logging information for Classroom 11 has incorrect date/time information from prior to the update. The assessment and recommendations contained in this report are in accordance with currently accepted industrial hygiene practices. Other than this no warranty is implied or intended.

APPENDIX A

FLOOR PLAN
SHOWING SAMPLING LOCATIONS

Sky Valley Education Center



APPENDIX B

LAB/COR, INC.
ANALYTICAL RESULTS

Lab/Cor, Inc.
7619 6th Ave NW
Seattle, WA 98117

Analysis Report Cover

Final Report

A Professional Service Corporation in the Northwest

Phone: (206) 781-0155
Fax: (206) 789-8424
http://www.labcor.net

Job Number: 140917 **SEA**

Report Number: 140917R01

Report Date: 11/10/2014

Client: EHS International, Inc.

Address: 13228 NE 20th St
Suite 100
Bellevue, WA 98005

Project Name: Sky Valley Ed Center

Project No.: 10693-01

PO Number: 10693-01

Sub Project:

Reference No.:

Enclosed please find results for samples submitted to our laboratory. A list of samples and analyses follows:

Lab/Cor Sample #	Client Sample # and Description	Analysis	Analysis Notes	Date Received:
140917 - S1	19776509 - Rm #11	NV, Air, Fungal & Part. ID		11/6/2014
140917 - S2	19776510 - OA	NV, Air, Fungal & Part. ID		11/6/2014
140917 - S3	19776710 - Rm #9	NV, Air, Fungal & Part. ID		11/6/2014

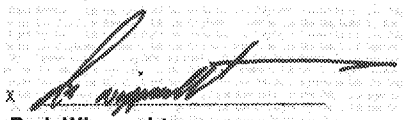
Nonviable Air Air samples follow preparation and analysis techniques outlined in Method 5 of the laboratory SOP. Samples were collected using either an Air-O-Cell, Cyclex–D, Allegenco-D, or M2 Multi-Mold nonviable air sampling cassette. Characteristic morphologies were observed by optical microscopy at a magnification of 600x. For each individual particle type observed, data was reported in particles per cubic meter of air (m3).

Due to various factors that influence uncertainty (media type, particle loading, staining, instrumentation and other variable aspects of the method), only the first two figures reported are considered to be significant. The area analyzed on each sample is 20%.

Disclaimer The results reported relate only to the samples tested or analyzed; the laboratory is not responsible for data collected by personnel who are not affiliated with the laboratory. Results reported in both structures/cm3 and structures/mm2 are dependent on the sample volume and area. These parameters are measured and recorded by non-laboratory personnel and are not covered by the laboratory's accreditation. Interpretation of these results is the sole responsibility of the client.

If further clarification of these results is needed, please call us. Thank you for allowing the staff at Lab/Cor, Inc. the opportunity to provide you with the analytical services.

Sincerely,



Derk Wipprecht
Laboratory Supervisor

Lab/Cor, Inc.
7619 6th Ave NW
Seattle, WA 98117

Final Report

Phone: (206) 781-0155
Fax: (206) 789-8424
http://www.labcor.net

A Professional Service Corporation in the Northwest

Nonviable Air

Job Number: 140917
Client: EHS International, Inc.
Project Name: Sky Valley Ed Center
Project No.: 10693-01
Reference No.:

Report Number: 140917R01
Date Received: 11/6/2014

Lab/Cor ID:	S1	S2
Sample No.:	19776509	19776510
Description:	Rm #11	OA
Sample Measure:	150 L	150 L
Media Type:	Fungal-Air-O-Cell	Fungal-Air-O-Cell
Analyst - Analysis Date:	DW - 11/10/2014	DW - 11/10/2014
MRL:	33	33
Scope - Magnification:	Olympus BHS - 600	Olympus BHS - 600
Notes:		

Fungal Identification	Raw Count*	Total Count**	Total/m³	Raw Count*	Total Count**	Total/m³
Ascospores	3	15	100	26	130	867
Aspergillus/ Penicillium-like	20	100	667	63	315	2100
Basidiospores	24	120	800	198	990	6600
Cladosporium	7	35	233	21	105	700
Epicoccum				2	10	67
Ganoderma	3	15	100	3	15	100
Hyphal Fragments	1	5	33	3	15	100
Myxo./ Periconia/ Smuts	1	5	33	2	10	67
Pithomyces	3	15	100			
Rust Spore				2	10	67
Summary Total:	**62**	**310**	**2066**	**320**	**1600**	**10668**

Nonfungal Identification	Raw Count*	Total Count**	Total/m³	Raw Count*	Total Count**	Total/m³
Algae	3	15	100	4	20	133
Amorphous Particulates	1254	6270	41800	29	145	967
Cotton Fibers	21	105	700	1	5	33
Crystalline Particulates	1749	8745	58300	52	260	1733
Dander	161	805	5367	9	45	300
Insect Parts	1	5	33			
Manufactured Fibers	1	5	33			
Paint Spheres/ Chips	47	235	1567			
Soot	50	250	1667	1	5	33
Starch	6	30	200			
Summary Total:	**3293**	**16465**	**109767**	**96**	**480**	**3199**

* - Raw Counts per 20% of Sample
** - Total Count per Sample

Lab/Cor, Inc.
7619 6th Ave NW
Seattle, WA 98117

Final Report

Phone: (206) 781-0155
Fax: (206) 789-8424
http://www.labcor.net

A Professional Service Corporation in the Northwest

Nonviable Air

Job Number: 140917
Client: EHS International, Inc.
Project Name: Sky Valley Ed Center
Project No.: 10693-01
Reference No.:

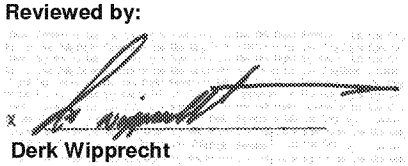
Report Number: 140917R01
Date Received: 11/6/2014

Lab/Cor ID:	**S3**	
Sample No.:	19776710	
Description:	Rm #9	
Sample Measure:	150 L	
Media Type:	Fungal-Air-O-Cell	
Analyst - Analysis Date:	DW - 11/10/2014	
MRL:	33	
Scope - Magnification:	Olympus BHS - 600	
Notes:		

Fungal Identification	Raw Count*	Total Count**	Total/m³	Raw Count*	Total Count**	Total/m³
Ascospores	9	45	300			
Aspergillus/ Penicillium-like	6	30	200			
Basidiospores	42	210	1400			
Cladosporium	4	20	133			
Epicoccum						
Ganoderma	5	25	167			
Hyphal Fragments	6	30	200			
Myxo./ Periconia/ Smuts						
Pithomyces						
Rust Spore						
Summary Total:	**72**	**360**	**2400**			

Nonfungal Identification	Raw Count*	Total Count**	Total/m³	Raw Count*	Total Count**	Total/m³
Algae	1	5	33			
Amorphous Particulates	1007	5035	33567			
Cotton Fibers	30	150	1000			
Crystalline Particulates	677	3385	22567			
Dander	372	1860	12400			
Insect Parts						
Manufactured Fibers	2	10	67			
Paint Spheres/ Chips	68	340	2267			
Soot	42	210	1400			
Starch	2	10	67			
Summary Total:	**2201**	**11005**	**73368**			

Reviewed by:



Derk Wipprecht
Laboratory Supervisor

* - Raw Counts per 20% of Sample
** - Total Count per Sample

Fungal / Particulate Sample Chain of Custody Record

140917

Lab/Cor, Inc
7619 6th Ave NW
Seattle, WA 98117

Office (206) 781-0155
Fax (206) 789-8424

mail@labcor.net
www.labcor.net

Client: EHS-International, Inc.
Address: 13228 NE 20th St. STE 100
City, State, Zip: Bellevue WA 98005
Contact: Clinton Holzhauer
Phone: 925-455-2959 Fax:
Email: clintonh@ehsintl.com
Other Info:

Analysis Type:
Nonviable Options:
- ___ Fungal ID
- X Fungal & Particulate ID
- ___ Particulate ID
- ___ Quantitative Analysis *(Total Count)*
- ___ Qualitative Analysis *(Relative Abundance)*

Viable Options:
- ___ Complete Analysis
- ___ Genera Only ___ Stachy Only

Turnaround Time:
- ___ 6 hr **RUSH***
- ___ 24 hours*
- ___ 48 hours
- X 3 days *(NV Std)*
- ___ 5 days
- ___ Viable *(7-10 days)*

Project Name: Sky Valley Ed. Center **Project Number:** 10693-01 **P.O. Number:** 10693-01

Sample #	Sample Description	Sample Information: Sample Type: Air NV	Air V	Swab NV	Swab V	Bulk NV	Bulk V	Dust NV	Dust V	Tape NV	Media Type: MEA	Stachy	Other	Sampling Information: Sample Date	Sample Time On	Sample Time Off	Sample Flow Rate Start	Sample Flow Rate End	Sample Flow Rate Avg	Total Volume / Area
19776509	Rm #11	✓												11/6/14	10:38	10:46	15.0	15.0	15.0	150L
19776510	OA	✓												11/6/14	10:50	10:40	15.0	15.0	15.0	150L
19776710	Rm #9	✓												11/6/14	12:01	12:11	15.0	15.0	15.0	150L

Internal Lab Use Only
Received: By: Email Phone Fax In Person
Relinquished: By: Email Phone Fax In Person

By signing below you are agreeing to comply with Lab/Cor's Requests, Tenders and Contracts.

** Call ahead for TATs of 24hrs or less*

Relinquished by: [signature] Date: 11/6/14 Time: 14:53
Received by: Ryan Nelson Date: 11/6/14 Time: 1453
Relinquished by: ___ Date: ___ Time: ___
Received by: ___ Date: ___ Time: ___

APPENDIX C

PHOTOGRAPHIC LOG

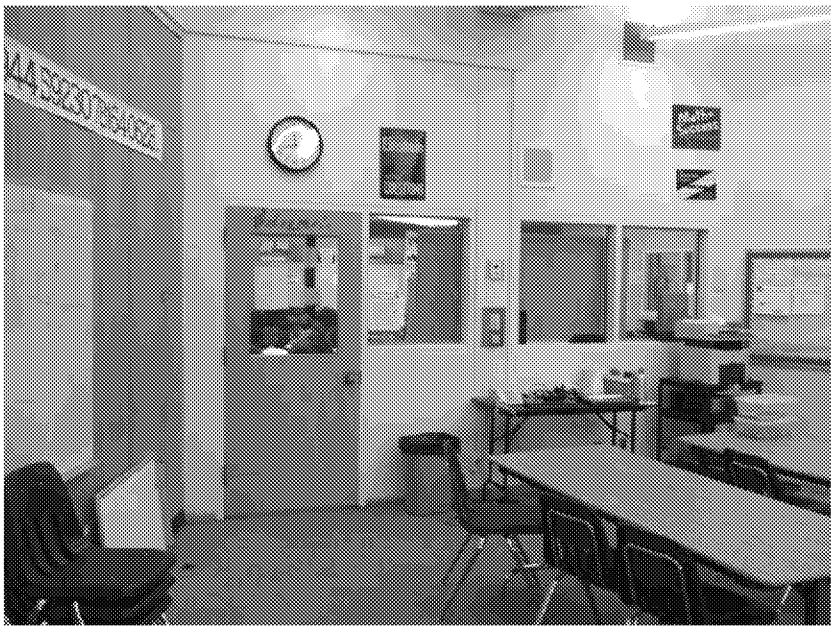


PHOTO #1: Classroom 11—view towards interior door. The East Pod Central common area is beyond the interior window.

PHOTO #2: Classroom 9—Science Classroom

PHOTO #3: Classroom 10— Computer Lab. The exterior door is visible near the top right of the photo.

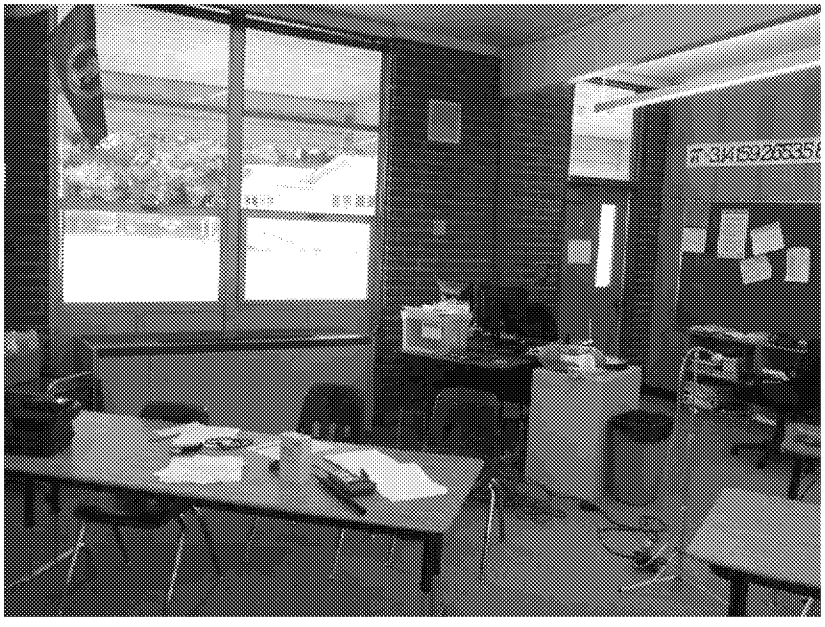


PHOTO #4: Classroom 11—The unit ventilator is positioned below the exterior window. The door to the exterior is visible towards the right side of the photo. Air sampling is taking place with the sampling cassette on a tripod towards the right of the photo.

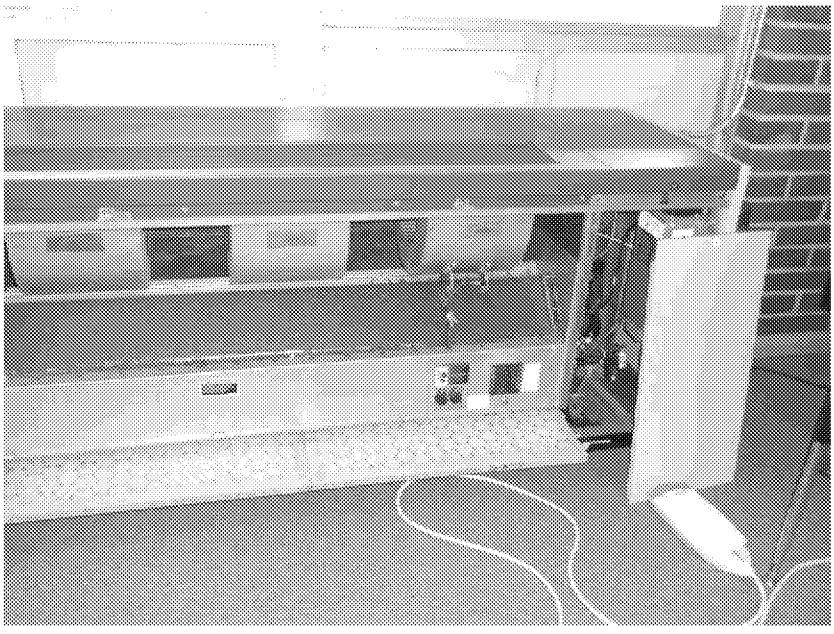


PHOTO #5: An open unit ventilator in Classroom 11. The filter are partially pulled out and appear to be clean and dry.

PHOTO #6: The exterior air intakes immediately outside from the unit ventilator in Classroom 11. The vents are protected against damage from skateboards and other activities by grilles. The grilles have iron corrosion. No dampers appear to be present at this air intake.

PHOTO #7: The air intake for Classroom 9 or 10. dampers are present in this air intake and appeared to be mostly, but not entirely, closed at the time of the assessment.

PHOTO #8: Carpet by the exterior door in Classroom 11. A portion of the carpet had been cut out at some point in the past and is now held in place by duct tape.

PHOTO #9: When pulled back, the carpet by the door shows that the mastic on has been well-cured and some mastic remains on both the carpet backing and the concrete slab. The darker discoloration near the edge of the carpet that abuts the exterior door threshold was slightly "crusty".

PHOTO #10: Concrete slab and carpet at a seam near the middle of a Classroom. The mastic is well-cured and both the carpet backing and the concrete slab have some mastic adhered to the surface.

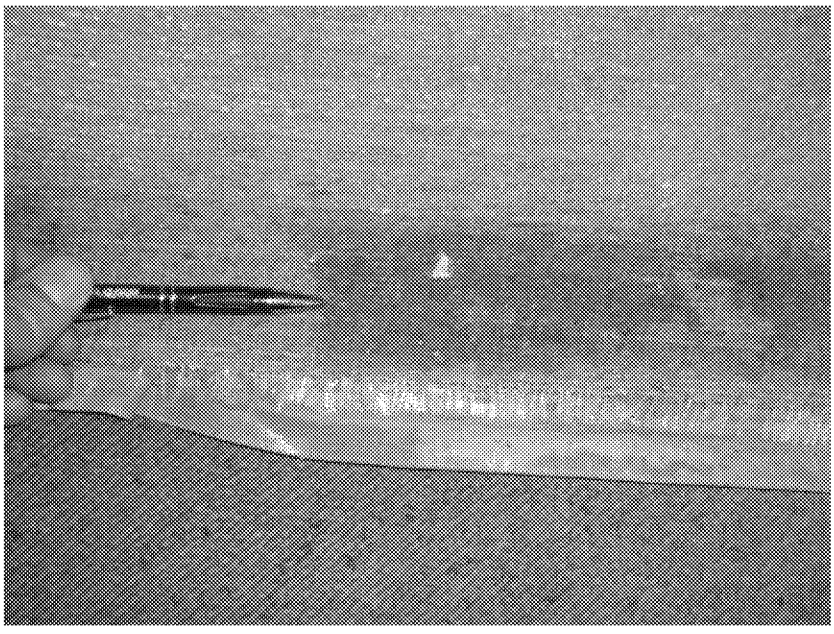


PHOTO #11: A closer look at the darker discoloration on the carpet near the exterior door threshold in Classroom 11. This small area of discoloration was "crusty" and may have some limited associated microbial growth. At the time of the assessment the carpet was not wet and there was no indication of suspect visible mold growth.

APPENDIX D

Q-TRAK DATA-LOGGING RESULTS

CLASSROOMS 9 & 11

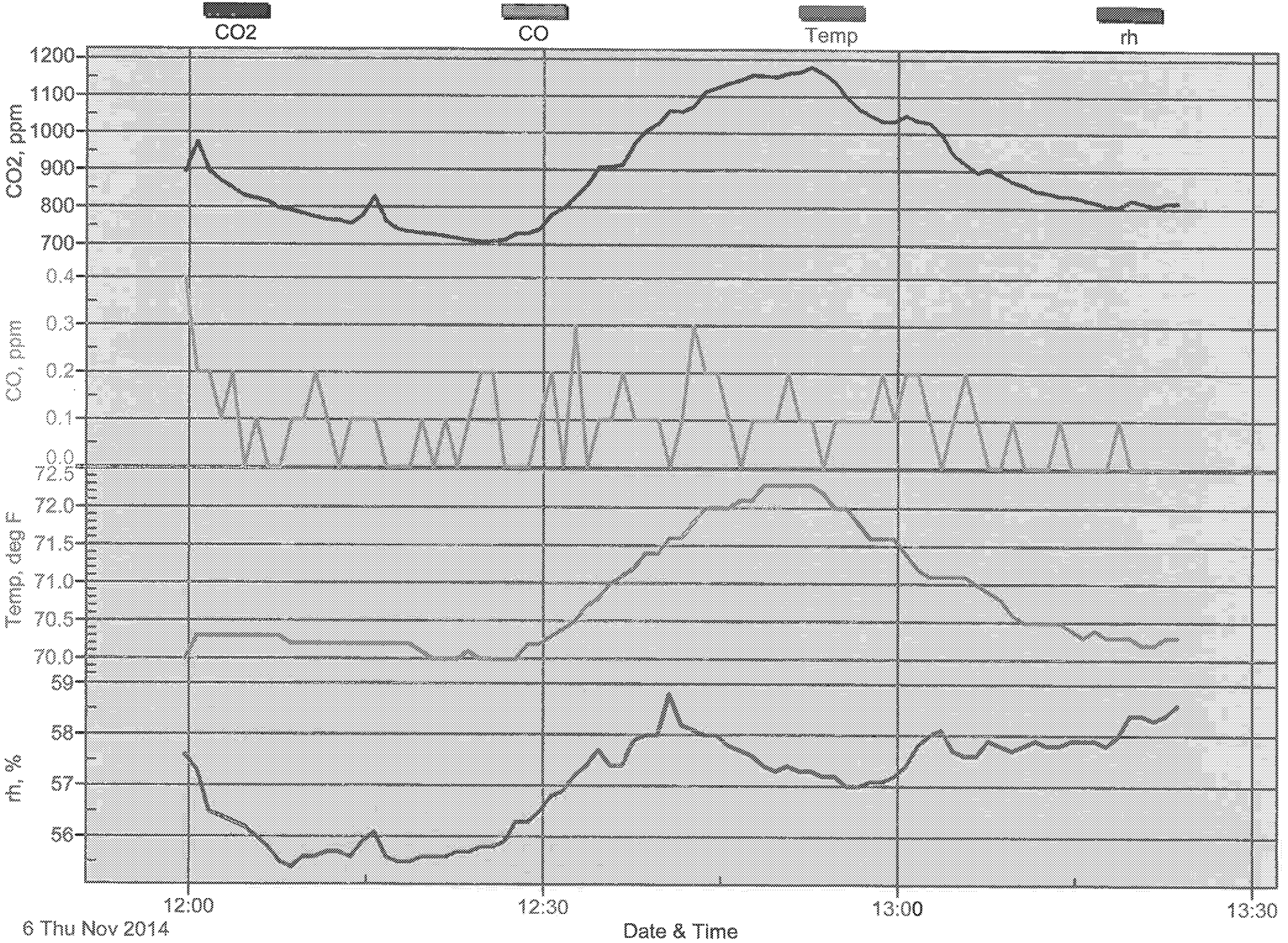
Sky Valley Education Center
Classroom 9
IAQ Parameters
November 6, 2014

Instrument		Data Properties	
Model	Q-Trak Plus	Start Date	11/06/2014
Meter S/N	8554-08061026	Start Time	11:58:40
-		Stop Date	11/06/2014
-		Stop Time	13:23:40
-		Total Time	0:01:25:00
-		Logging Interval	60 seconds

Statistics				
	CO2	CO	Temp	rh
Avg	901 ppm	0.1 ppm	70.8 deg F	57.1 %
Max	1180 ppm	0.4 ppm	72.3 deg F	58.8 %
Max Date	11/06/2014	11/06/2014	11/06/2014	11/06/2014
Max Time	12:52:40	11:59:40	12:48:40	12:40:40
Min	709 ppm	0.0 ppm	70.0 deg F	55.4 %
Min Date	11/06/2014	11/06/2014	11/06/2014	11/06/2014
Min Time	12:24:40	12:04:40	11:59:40	12:08:40
TWA (8 hr)	159	0.0		
TWA Start Date	11/06/2014	11/06/2014		
TWA Start Time	11:58:40	11:58:40		
TWA End Time	13:23:40	13:23:40		

Classroom 9

November 6, 2014



Sky Valley Education Center
Classroom 11
IAQ Parameters
November 6, 2014

Instrument		Data Properties	
Model	Q-Trak Plus	Start Date	11/06/2014
Meter S/N	8554-08061026	Start Time	11:04:13
-		Stop Date	11/06/2014
-		Stop Time	12:09:13
-		Total Time	0:01:05:00
-		Logging Interval	60 seconds

Statistics				
	CO2	CO	Temp	rh
Avg	782 ppm	0.1 ppm	70.3 deg F	56.5 %
Max	855 ppm	0.4 ppm	71.6 deg F	59.2 %
Max Date	11/06/2014	11/06/2014	11/06/2014	11/06/2014
Max Time	11:21:13	11:59:13	11:22:13	11:05:13
Min	691 ppm	0.0 ppm	69.6 deg F	55.2 %
Min Date	11/06/2014	11/06/2014	11/06/2014	11/06/2014
Min Time	11:14:13	11:05:13	11:10:13	12:06:13
TWA (8 hr)	106	0.0		
TWA Start Date	11/06/2014	11/06/2014		
TWA Start Time	11:04:13	11:04:13		
TWA End Time	12:09:13	12:09:13